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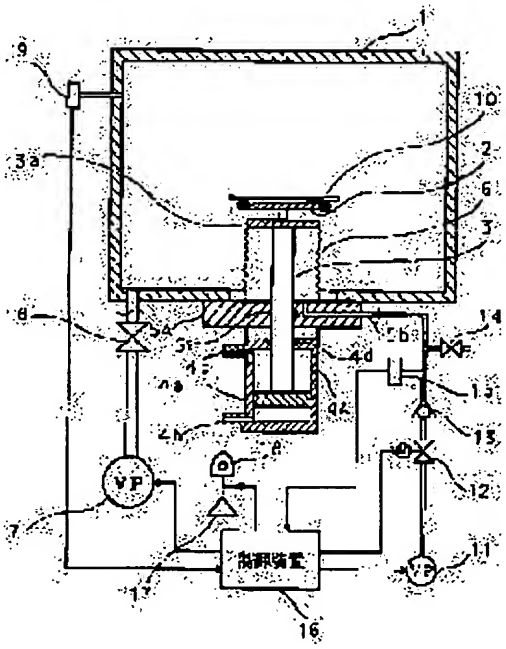
(54) VACUUM TREATING APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a vacuum treating apparatus which can early detect a a very small gas leak due to cracking of vacuum sealing bellows, etc., and is easy to monitor the gas leak condition.

SOLUTION: A vacuum pressure sensor 9 for measuring the vacuum pressure in a vacuum treating chamber 1, a vacuum pump 11 for evacuating the inside hollow of bellows 6 covering an exposed part in the vacuum treating chamber 2 at a shaft 3 reciprocally movable through the vacuum treating chamber 1, and a vacuum pressure sensor 15 for measuring the vacuum pressure in the inside hollow of the bellows 6 are provided. By detecting that the measured value by the vacuum pressure sensor 15 varies, following the measured value of the vacuum pressure sensor 9, damage to the bellows 6 is detected to alarm.



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* NOTICES *

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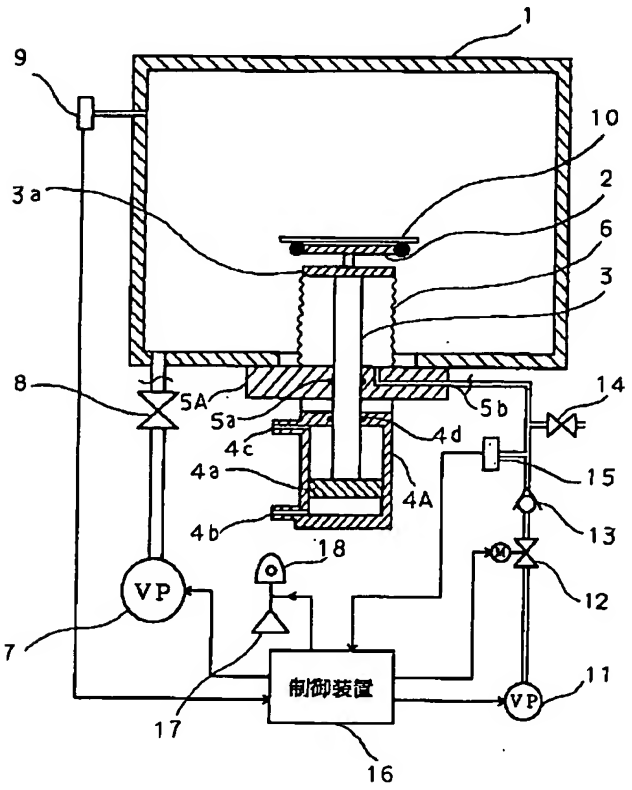
CLAIMS

[Claim(s)]
[Claim 1] The vacuum processor equipped with a vacuum processing room, the rod-like structure which penetrates this vacuum processing room and reciprocates, the driving source which makes this rod-like structure reciprocate, the bellows which fit loosely into the method of wrap aforementioned rod-like structure, are interlocked with reciprocation of said rod-like structure, and expand and contract the part exposed to said vacuum processing interior of a room in said rod-like structure, and an exhaust air means in bellows to exhaust this cavernous section in bellows.
[Claim 2] It is the vacuum processor characterized by the driving source of a rod-like structure being an air cylinder in a vacuum processor according to claim 1.
[Claim 3] The part which exposed the vacuum processing room and this vacuum processing room to said vacuum processing interior of a room in the rod-like structure which penetrates and reciprocates, and this rod-like structure Wrap bellows, It has an exhaust air means in bellows to exhaust this cavernous section in bellows, and a vaccum pressure measurement means in bellows to measure the vaccum pressure of said cavernous section in bellows. The vacuum processor characterized by detecting the abnormalities of said bellows by fluctuation detection of the vaccum pressure in said cavernous section in bellows by this vaccum pressure measurement means in bellows.
[Claim 4] The part which exposed the vacuum processing room and this vacuum processing room to said vacuum processing interior of a room in the rod-like structure which penetrates and reciprocates, and this rod-like structure Wrap bellows, An exhaust air means in bellows to exhaust this cavernous section in bellows, and a vaccum pressure measurement means in bellows to measure the vaccum pressure of said cavernous section in bellows, The vacuum processor characterized by having a vacuum processing indoor vaccum pressure measurement means to measure the vaccum pressure of said vacuum processing interior of a room, and detecting the abnormalities of said bellows by the comparison of the measurement value by this vacuum processing indoor vaccum pressure measurement means and said vaccum pressure measurement means in bellows.
[Claim 5] The vacuum pump to which the exhaust air means in bellows carries out evacuation of the vacuum processing interior of a room in a vacuum processor according to claim 3 or 4 is a vacuum processor characterized by having the vacuum pump of another system.
[Claim 6] It is the vacuum processor characterized by sharing the vacuum pump with which the exhaust air means in bellows carries out evacuation of the vacuum processing interior of a room in a vacuum processor according to claim 3 or 4.

[Translation done.]

Drawing selection Representative drawing



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates the part which exposed the vacuum processing room to the vacuum processing interior of a room in the rod-like structure which penetrates and reciprocates to the vacuum processor equipped with wrap bellows.
[0002]
[Description of the Prior Art] Drawing 4 is a schematic diagram including the important section cross section in the vacuum processor which used the bellows for the conventional vacuum seals. In drawing, the wafer support with 1 [disc-like / a vacuum processing room and 2] and 2a are the O rings prepared in the periphery of the wafer support 2, and are prepared as an object for the skids of the below-mentioned semi-conductor wafer 10 laid in said wafer support 2. A piston [in / an air oil cylinder and 4a 3, and / in 4 / the air oil cylinder 4] and 4b are [an oil gate and 4d of an air gate and 4co] the O rings for seal. [a shaft]
[0003] A flange for 5 to attach the air oil cylinder 4 in the vacuum processing room 1 and 6 are prepared in the interior of the vacuum processing room 1, and are expanded and contracted according to vertical actuation of a shaft 3, and the bellows holding the vacuum ambient atmosphere of the vacuum processing room 1 for vacuum seals and 6a are bellows end plates, and are being fixed at the head of a shaft 3. In addition, the end is combined with bellows end plate 6a, and, as for bellows 6, the other end is combined with the flange 5. Moreover, the wafer support 2 is attached on bellows end plate 6a.
[0004] The vacuum pump to which 7 exhausts the vacuum processing room 1 with evacuation, the exhaust air bulb by which 8 adjusts exhaust air by said evacuation, and 9 are vaccum pressure sensors which measure the vaccum pressure of the vacuum processing room 1. 10 is a semi-conductor wafer which is a workpiece.
[0005] Next, actuation is explained. If the conveyance process of the semi-conductor wafer 10 is taken for an example, first, evacuation of the vacuum processing room 1 will be carried out to predetermined vaccum pressure by the vacuum pump 7, and the semi-conductor wafer 10 will be guided and laid after the wafer support 2 in this condition. Next, while the supplied air of the air is carried out from air gate 4b into the air oil cylinder 4, the shaft 3 directly linked with piston 4a goes up and bellows 6 develops, the semi-conductor wafer 10 laid in the wafer support 2 on bellows end plate 6a is lifted. And if the semi-conductor wafer 10 reaches the position in the vacuum processing room 1, processing beforehand planned by the semi-conductor wafer 10 on the wafer support 2 will be performed.
[0006] Next, the shaft 3 directly linked with piston 4a by feeding oil from oil gate 4co into the air oil cylinder 4 descends, and the semi-conductor wafer 10 laid in the wafer support 2 descends, and bellows 6 is also contracted according to this.
[0007] When bellows 6 expands and contracts, a crack occurs with the metal fatigue of bellows 6 the very thing, and the foreign matter at the time of processing. Or by the gas used for processing, corrosion takes place and a pinhole occurs. And atmospheric air was revealed from the crack and pinhole part of bellows 6 to the vacuum processing room 1, in this case, the atmospheric air containing an impurity has

an adverse effect on processing of the semi-conductor wafer 10, or causing the failure in the vacuum processing room 1 often occurs. And since a sign cannot catch this phenomenon easily, life management of bellows 6 is very difficult for it.
[0008] Moreover, by the vaccum pressure sensor 9 with which the vacuum processing room 1 is equipped when leakage of a minute amount occurs from the pinhole part of bellows 6, generating of this leakage is undetectable. In addition, it is known that the metal fatigue of bellows 6 the very thing has so large that the differential pressure between the inside in bellows 6 and an outside is large effect.
[0009] furthermore, when the outside in bellows 6 is in a vacua and the inside is in the condition of an atmospheric pressure, the direction of the pantograph adherence pressure by the atmospheric pressure which joins bellows end plate 6a is markedly alike, it is large and the wafer support 2 receives mighty upward force from the sum total of a self-weight of the wafer support 2, a shaft 3, piston 4a, and bellows end plate 6a. Therefore, as a driving source of a shaft 3 which moves the semi-conductor wafer 10 up and down, if an air cylinder (not shown) is used, opening adjustment of ******** (not shown) of the air for actuation of this air cylinder is difficult, the wafer support 2 goes up steeply, it is shocking, the semi-conductor wafer 10 dances, and the possibility of having an adverse effect on the installation exists.
[0010] So, when the air oil cylinder 4 which has damper ability was used as said driving source, and the wafer support 2 operates smoothly and uses said air cylinder by adoption of the air oil cylinder 4, it does not operate [like] steeply. Thus, although the wafer support 2 will operate smoothly and will not operate steeply if the oil cylinder (not shown) or the air oil cylinder 4 which has damper ability is used, as compared with an air cylinder (not shown), a device will become complicated and expensive.
[0011]
[Problem(s) to be Solved by the Invention] Since the vacuum processing room 1 was covered with the open air with the bellows 6 for vacuum seals, the conventional vacuum processor While bellows 6 is damaged by the metal fatigue, corrosion, etc., and atmospheric-air leakage occurs from bellows 6 and having an adverse effect on the semi-conductor wafer 10 under processing while having an adverse effect also on the exhaust air system and the equipment itself of the vacuum processing room 1, in order that generating of the atmospheric-air leakage by degradation of the metal bellows 6 may present burst nature, it is very difficult to catch the sign of degradation and to carry out life management -- etc. -- there was a trouble. Moreover, since the air oil cylinder 4 which has damper ability was used as a driving source for raising smoothly the wafer support 2 which laid the semi-conductor wafer 10, there were troubles, like the device of said driving source will become complicated and expensive.
[0012] This invention is made in order to cancel the above troubles, and it aims at obtaining the vacuum processor which was comparatively simple and constituted the driving source of a processed object cheaply while the monitor of the gas leakage resulting from abnormalities, such as breakage of BEROSU for vacuum seals, is easy.
[0013]
[Means for Solving the Problem] The vacuum processor concerning the 1st invention fits loosely into the method of wrap aforementioned rod-like structure a vacuum processing room, the rod-like structure which penetrates this vacuum processing room and reciprocates, the driving source which makes this rod-like structure reciprocate, and the part exposed to said vacuum processing interior of a room in said rod-like structure, and is equipped with the bellows which is interlocked with reciprocation of said rod-like structure, and is expanded and contracted, and an exhaust-air means in bellows exhaust this cavernous section in bellows.
[0014] In the vacuum processor which the vacuum processor concerning the 2nd invention requires for the 1st invention, the driving source of a rod-like structure is an air cylinder.
[0015] The rod-like structure which the vacuum processor concerning the 3rd invention penetrates a vacuum processing room and this vacuum processing room, and reciprocates, The part exposed to said vacuum processing interior of a room in this rod-like structure Wrap bellows, It has an exhaust air means in bellows to exhaust this cavernous section in bellows, and a vaccum pressure measurement means in bellows to measure the vaccum pressure of said cavernous section in bellows. Fluctuation detection of the vaccum pressure in said cavernous section in bellows by this vaccum pressure

measurement means in bellows detects the abnormalities of said bellows.
[0016] The rod-like structure which the vacuum processor concerning the 4th invention penetrates a vacuum processing room and this vacuum processing room, and reciprocates, The part exposed to said vacuum processing interior of a room in this rod-like structure Wrap bellows, An exhaust air means in bellows to exhaust this cavernous section in bellows, and a vaccum pressure measurement means in bellows to measure the vaccum pressure of said cavernous section in bellows, It has a vacuum processing indoor vaccum pressure measurement means to measure the vaccum pressure of said vacuum processing interior of a room, and the comparison of the measurement value by this vacuum processing indoor vaccum pressure measurement means and said vaccum pressure measurement means in bellows detects the abnormalities of said bellows.
[0017] The vacuum processor concerning the 5th invention is equipped with the vacuum pump of another system in the vacuum processor concerning invention given in the 3rd or 4th any they are with the vacuum pump to which the exhaust air means in bellows carries out evacuation of the vacuum processing interior of a room.
[0018] The vacuum processor concerning the 6th invention shares the vacuum pump with which the exhaust air means in bellows carries out evacuation of the vacuum processing interior of a room in the vacuum processor concerning invention given in the 3rd or 4th any they are.
[0019]
[Embodiment of the Invention] gestalt 1. of operation -- the gestalt 1 of implementation of this invention is explained based on drawing 1 . The schematic diagram with which drawing 1 includes the important section cross section in a vacuum processor, and drawing 2 are the explanatory views of the vacuum processor shown in drawing 1 of operation. A thing that what was shown with the same sign as the conventional example is the same as that of it of the conventional example, or equivalent is shown among drawing. In drawing 1 , 4A is 4b and an air cylinder and 4c are air gates. Moreover, in order that a vacuum O ring for a flange and 5a to carry out the vacuum seal of between flange 5A and shafts 3 in 5A and 5b may exhaust the inside of bellows 6, it is the exhaust port established in flange 5A, and it comes to connect with flange 5A the exhaust pipe which connects the inside opening section of bellows 6, and exhaust-port 5b.
[0020] In addition, in shaping or a metal plate, it welds one metal at a time, and the bellows 6 for vacuum seals based on this invention is formed [metal] so that it can expand and contract. Moreover, 9 is a vaccum pressure sensor as a vacuum processing indoor vaccum pressure measurement means to output a measurement signal while measuring and displaying the vaccum pressure of the vacuum processing room 1.
[0021] Moreover, 11 is a vacuum pump only in bellows 6 and for exhaust air, 12 is an exhaust air bulb, and the opening is controlled by the below-mentioned control unit 16. Although the suction gas capacity of a vacuum pump 11 is comparatively small, a ultimate vacuum is a thing comparatively high type. The vaccum pressure of the cavernous section in bellows is measured, it is the vaccum-pressure sensor 15 as a vaccum pressure measurement means in bellows to output a measurement signal, the exhaust air bulb 12, the check valve 13, the bulb 14 for a purge, and the vaccum-pressure sensor 15 have been attached between exhaust-port 5b and a vacuum pump 11, and the bulb for a purge for 13 to carry out a check valve and for 14 carry out atmospheric-air disconnection of the inside of bellows and 15 constitute the exhaust-air means in bellows by the vacuum pump 11 and the exhaust-air bulb 12.
[0022] in addition, the diaphragm gage which changes and uses for an electrical signal the elastic deformation of the diaphragm by the pressure differential which can measure the ionization vacuum gage which uses a ionization operation of the residual gas by the thermoelectron which can measure a high vacuum (10-5 to ten to 1 Pa) as the vaccum pressure sensor 9 and a vaccum pressure sensor 15, a medium vacuum (10+2 to ten to 1 Pa), and a low vacuum (10+2Pa or more) -- independence -- or it combines and uses.
[0023] As for the control device as a control means, and 17, 16 is [a buzzer and 18] PATORAITO, and a control device inputs the output signal of the vaccum pressure sensor 9 and the vaccum pressure sensor 15, performs operation of a vacuum pump 11, halt control, and closing motion control of the exhaust air

bulb 12, and carries out the alarm of the abnormalities immediately by the buzzer 16 and PATORAITO 17 at the time of abnormal occurrences, such as a crack of bellows 6.
[0024] Next, actuation is explained. First, if a vacuum pump 11 is operated, full admission actuation of the exhaust air bulb 12 is carried out, evacuation of the inside cavernous section of bellows 6 is carried out and predetermined vaccum pressure is reached while operating a vacuum pump 7, carrying out open actuation of the exhaust air bulb 8 and carrying out evacuation of the interior of the vacuum processing room 1 to predetermined vaccum pressure, the close by-pass bulb completely of the exhaust air bulb 12 will be carried out. In addition, when the close by-pass bulb completely of the exhaust air bulb 12 is carried out, if it seems that the pressure up of the vaccum pressure of the inside cavernous section of the bellows 6 according [gas / which occurs from the wall of bellows 6 etc. / out] to minute amount gas very much poses a problem, the opening of the exhaust air bulb 12 will be extracted to extent which balances with such capacity, and a vacuum pump 11 will be run continuously.
[0025] Next, vertical conveyance is carried out that the semi-conductor wafer 10 as a processed object should be set to the predetermined location in the vacuum processing room 1. Next, by carrying out the supplied air of the air to air gate 4b in air cylinder 4A, the shaft 3 directly linked with piston 4a is raised, and the semi-conductor wafer 10 in the vacuum processing room 1 is carried in the wafer support 2, it conveys up, and predetermined processing to the semi-conductor wafer 10 is performed. After finishing this processing, a shaft 3 is dropped by carrying out the supplied air of the air to air gate 4c.
[0026] The vaccum pressure of the inside-and-outside section of bellows 6 is always measured by the vaccum pressure sensor 9 and the vaccum pressure sensor 15 during flexible actuation of bellows 6, these measurement signals are inputted into a control device 16, and as range of an all seems well, like the above-mentioned, lifting of the vaccum pressure according [gas / which occurs in the inside opening section of bellows 6 / out] to the gas of a minute amount very much is exhausted appropriately, and is held to predetermined vaccum pressure. And in being the abnormal condition which the gas leakage by breakage of bellows 6, degradation of O ring 5a, etc. produced, from vaccum pressure lifting of the inside opening section of bellows 6, gas leakage is detected and it generates an alarm by the buzzer 16 or PATORAITO 17.
[0027] For example, as shown in drawing 2 , evacuation of the vacuum processing room 1 is carried out to the vaccum pressure of 10-3Pa by the vacuum pump 7. In the all seems well which is changed by impregnation of the raw gas to the semi-conductor wafer 10 in the range of a to ten to 1 Pa 10-3P and by which evacuation of the inside cavernous section of bellows 6 is carried out to the vaccum pressure of ten to 4 Pa with a vacuum pump 11 Fluctuation of the vaccum pressure Vr of the vacuum processing room 1 is measured by the vaccum pressure sensor 9, on the other hand, it is measured by the vaccum pressure sensor 15, both the measurement signal is inputted into a control unit 16, and the vaccum pressure Vbn of the inside cavernous section of bellows 6 judges said condition to be an all seems well with a control unit 16.
[0028] In drawing 2 , when breakage of a crack etc. arises in bellows 6, for example when abnormalities are produced in bellows 6 at time of day tb, and a comparatively big hole opens, the vaccum pressure Vbl of the inside cavernous section of bellows 6 goes up to the almost same vaccum pressure as the vaccum pressure Vr of the vacuum processing room 1, and is followed and changed to fluctuation of the vaccum pressure Vr of the vacuum processing room 1. Lifting and fluctuation of this vaccum pressure Vbl are measured by the vaccum pressure sensor 15, this measurement signal is inputted into a control device 16 with the vaccum pressure Vr measurement value by the vaccum pressure sensor 9, and based on said both measurement values, a control device 16 is judged to be an abnormal condition, and carries out the alarm of the abnormalities by the buzzer 16 or PATORAITO 17.
[0029] When comparatively minute breakage, for example, a pinhole, is produced in bellows 6, as a dotted line shows to drawing 2 , although the vaccum pressure Vbs of the inside cavernous section of bellows 6 follows fluctuation of the vaccum pressure Vr of the vacuum processing room 1, a time lag is produced, and the range of fluctuation also becomes small. A control unit 16 judges extent of breakage of bellows 6 with extent of reduction of the flattery time lag of fluctuation and the range of fluctuation to the vaccum pressure Vr of vaccum pressure Vbs.

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[0030] In addition, although gas leakage may originate in leakage from the part of O ring 5a which a shaft 3 penetrates, in distinction from breakage of bellows 6, it is distinguished by reaching the predetermined vaccum pressure level Ol on which the vaccum pressure VO of the inside cavernous section of bellows 6 exceeded the vaccum pressure Vr of the vacuum processing room 1.
[0031] Although reaching the vaccum pressure level Ol takes time amount when the ullage from the part of above and O ring 5a is a minute amount, a control device 16 asks for the dip of the pressure up of the inside cavernous section of bellows 6 to time amount progress, judges the size of a ullage by dip of this pressure up, when leakage is small, it delays the decision stage of a gas leakage class, it grasps the description of the change pattern of vaccum pressure to accuracy, and distinguishes a cause of leak. In addition, since the inclination of vaccum pressure lifting over time amount progress of the inside cavernous section of the bellows 6 resulting from generating of out gas is usually very small as compared with said inclination which originates in minute leakage from minute breakage of bellows 6, or an O ring 5a part, it can distinguish both.
[0032] As mentioned above, in the gestalt 1 of operation, by measuring the vaccum pressure of the inside cavernous section of bellows 6 by the vaccum pressure sensor 15, and measuring the vaccum pressure of the vacuum processing room 1 by the vaccum pressure sensor 9, the vaccum pressure of bellows 6 inside and outside is supervised, and the leakage by breakage of bellows 6 can be detected to quick and high degree of accuracy regardless of the size of the ullage in distinction from the leakage from the part of O ring 5a which a shaft 3 penetrates. That is, in distinction from atmospheric-air leakage, the early detection of from leakage of the minute amount from bellows 6 to the big leakage can be carried out. As this result, while being able to plan the pollution control of the semi-conductor wafer 10 under processing with the vacuum processor, whenever [bellows's 6 degradation] could be supervised effectively and quick reinstatement was enabled.
[0033] In the gestalt 1 of operation in addition, after exhausting the inside cavernous section of bellows 6 below to predetermined vaccum pressure with a vacuum pump 11 Although the opening of the exhaust air bulb 12 was extracted to extent which balances with such capacity and evacuation was continuously carried out with the vacuum pump 11 when it seemed that the pressure up of the vaccum pressure of the inside cavernous section of the bellows 6 according [gas / which occurs from the wall of bellows 6 etc. / out] to minute amount gas very much became a problem Where the opening of the exhaust air bulb 12 is extracted, it is not necessarily necessary to run continuously a vacuum pump 11. Even if only a short time operates the exhaust air bulb 12 and between an aperture and this bulb open operates a vacuum pump 11 for every predetermined time amount progress, it is maintenance below at a predetermined value about the vaccum pressure of the inside cavernous section of the bellows 6 in always [forward], and energy saving can be attained.
[0034] Moreover, a vacuum pump 11 is made into the revolving-speed-control method using an inverter (not shown), and after the vaccum pressure of the inside cavernous section of bellows 6 reaching a predetermined value, energy saving can be attained, in spite of controlling the amount of exhaust gas of a vacuum pump 11 and running continuously a vacuum pump 11 by controlling said inverter by the control device 16.
[0035] gestalt 2. of operation -- the gestalt 2 of implementation of this invention is explained based on drawing 3 . Drawing 3 is a schematic diagram including the important section cross section in a vacuum processor. Although the configuration is almost the same as the gestalt 1 of operation shown in drawing 1 , there is not, makes the vacuum pump 7 for vacuum processing rooms serve a double purpose, and is exhausting the inside cavernous section of bellows 6. [of 11 vacuum pump shown in drawing 1]
[0036] Next, actuation is explained. By open actuation of the exhaust air bulb 12, the inside cavernous section of bellows 6 is exhausted with the vacuum pump 7 for vacuum processing rooms. That is, the exhaust air bulb 12 is opened fully at first, and the inside cavernous section of bellows 6 is exhausted quickly, and with a vacuum pump 7, after reaching predetermined vaccum pressure, it carries out the close by-pass bulb completely of the exhaust air bulb 12, and when the out gas breathed out from the inner surface of bellows 6 cannot be disregarded, it extracts and exhausts the exhaust air bulb 12 to extent which balances with this out gas. That is, the inside cavernous section of bellows 6 is almost

equal to the vacuum processing room 1, for example, evacuation is carried out to 10-3Pa.
[0037] Although the vacuum processing room 1 is changed by impregnation of the raw gas to the semi-conductor wafer 10 after the evacuation by the vacuum pump 7 in an all seems well without leakage in the range the vaccum pressure of whose is a to ten to 1 Pa 10-3P from breakage of bellows 6, or an O ring 5a part, the vaccum pressure of the inside cavernous section of bellows 6 can be held to almost predetermined vaccum pressure.
[0038] On the other hand, in the breakage condition of bellows 6, the vaccum pressure of the inside cavernous section of bellows 6 is interlocked with the vaccum pressure of the vacuum processing room 1, and is changed in the range of a to ten to 1 Pa 10-3P. Moreover, in a leakage condition, the vaccum pressure of the inside cavernous section of bellows 6 goes up exceeding the vaccum pressure of the vacuum processing room 1 from an O ring 5a part. The abnormal condition which leak from breakage of bellows 6 or an O ring 5a part be measure by the vaccum pressure sensor 15 with which the exhaust air system of the inside cavernous section of the vaccum pressure sensor 9 with which the vacuum processing room 1 be equip , and bellows 6 be equip like the case of the gestalt 1 of operation showed in drawing 1 , this measurement signal be input into a control device 16 , and a control device 16 judge an abnormal condition and its classification , and carry out the alarm of the abnormalities by the buzzer 16 or PATORAITO 17 .
[0039] since the inside cavernous section of bellows 6 was exhausted with the vacuum pump 7 for vacuum processing rooms in the gestalt 2 of operation -- space-saving-izing -- and the energy can be saved. that is, since the vacuum pump [inside / of the vacuum processing room 1 and bellows 6] 7 of exhaust air was shared, while being able to make slight stress to the bellows 6 by the differential pressure of the inside-and-outside section of bellows 6, it can fly in the vacuum processing room 1, the vacuum management with the inside of Lowe's 6 can be simplified equipment not only becomes small and cheap, but, and a management top is also highly convenient.
[0040] Moreover, in the gestalt 1 of operation, or the gestalt 2 of operation, although vaccum pressure of the inside cavernous section of the bellows 6 in always [forward] was set as the minimum value of the vaccum pressure in the vacuum processing room 1 to change lower than setting out (in the case of the gestalt 2 of operation), or the minimum value (in the case of the gestalt 1 of operation) Even if it is not necessary to necessarily set below to the minimum value for example, and sets it as a value lower enough than atmospheric pressure fluctuation within the limits of the vaccum pressure in the vacuum processing room 1 to change, or above a peak price, practically sufficient effectiveness is acquired.
[0041] For example, it sets from breakage of bellows 6, or an O ring 5a part to an all seems well without leakage. [when changing the vaccum pressure of the vacuum processing room 1 in the range which is a to ten to 1 Pa 10-3P] If the vaccum pressure of the inside cavernous section of bellows 6 is held to 1Pa, it will set in the breakage condition of bellows 6. The vaccum pressure of the inside cavernous section of bellows 6 declines, and the vaccum pressure of the vacuum processing room 1 is interlocked with, change in the range of a to ten to 1 Pa 10-3P, and it sets in the leakage condition from an O ring 5a part. The vaccum pressure of the inside cavernous section of bellows 6 goes up exceeding the vaccum pressure of the inside cavernous section of the bellows 6 of forward always. Therefore, a control unit 16 distinguishes said cause of leak with the vaccum pressure pattern according to each cause of leak.
[0042] Moreover, when the vaccum pressure of the inside cavernous section of bellows 6 is set to the mean value of the vaccum pressure in the vacuum processing room 1 to change, for example, ten to 2 Pa, it also sets. In the breakage condition of bellows 6, the vaccum pressure of the inside cavernous section of bellows 6 is interlocked with the vaccum pressure of the vacuum processing room 1, and is changed in the range of a to ten to 1 Pa 10-3P. When the vaccum pressure of the inside cavernous section of bellows 6 goes up in a leakage condition exceeding the vaccum pressure of the inside cavernous section of the bellows 6 of forward always from an O ring 5a part, leakage is detectable from breakage of bellows 6, or an O ring 5a part. However, the vaccum pressure in the vacuum processing room 1 is changed, and it becomes the conditions which can detect breakage of the bellows 6 which can set in this case that this fluctuation is detectable from the difference of the vaccum pressure sensor 9 and the vaccum pressure sensor 15.

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[0043] Furthermore, although the inner external pressure of bellows 6 was measured for an O ring 5a part to breakage of bellows 6, or leakage by the vaccum pressure sensor 9 and the vaccum pressure sensor 15, both measurement values detected in the gestalt 1 of operation, or the gestalt 2 of operation and the class of leakage was distinguished When the fluctuation pattern of the vaccum pressure of the vacuum processing room 1 is known beforehand, or when the fluctuation range is grasped in advance Both measurement values are not necessarily needed for said distinction, but at least the measurement value of the vaccum pressure of the inside cavernous section of the bellows 6 by the vaccum pressure sensor 15 can be distinguished from the change pattern of the vaccum pressure.
[0044] In addition, it can set in the gestalt 1 of operation, or the gestalt 2 of operation, the stress which joins bellows 6 as compared with the case where the inside cavernous section of bellows 6 is made into an atmospheric pressure, by carrying out evacuation of the inside and outside of six of the bellows in the vacuum processing room 1 can be reduced substantially, and reinforcement can be attained.
[0045] Furthermore, in the gestalt 1 of operation, or the gestalt 2 of operation, since evacuation of the inside-and-outside section of bellows 6 is carried out, opening adjustment of the valve (not shown) of the air gates 4b and 4c for there being no effect of the pantograph adherence pressure by the atmospheric pressure which joins bellows end plate 6a, and ******(ing) the air in air cylinder 4A is easy. Therefore, unlike the case of the conventional example shown in drawing 4 which has the inside of bellows 6 in the condition of atmospheric pressure, although it has damper ability instead of air cylinder 4A, it is not necessary to use an oil cylinder (not shown) complicated [a device] and expensive or an air oil cylinder (not shown), in order to move the semi-conductor wafer 10 up and down smoothly.
[0046] In addition, it cannot be overemphasized that it is equivalent to the vacuum processor of this invention not only at the vacuum processing room in semiconductor fabrication machines and equipment, such as a dry etcher (not shown) and a sputtering system (not shown), but a load lock chamber and a conveyance room, and this invention can be applied for example. Usually namely, in the case of said load lock chamber Change the internal pressure to 10-3Pa - atmospheric pressure, and, in the case of said conveyance room, the range of fluctuation of vaccum pressure is small as compared with said vacuum processing room, but Like the case of said vacuum processing room, from the fluctuation pattern of the vaccum pressure of the inside cavernous section of the bellows in comparison with always [forward], the existence of abnormal occurrences, such as leakage, can be detected from breakage and the O ring part of bellows, and the classification of abnormalities can be distinguished further.
[0047]
[Effect of the Invention] Since the inside cavernous section in the bellows which covered the part which exposed the vacuum processing room to said vacuum processing interior of a room of the rod-like structure which penetrates and reciprocates was exhausted according to the 1st invention The difference of a bellows inside-and-outside pressure decreases, the reciprocation force of said rod-like structure resulting from the difference of this bellows inside-and-outside pressure becomes comparatively small, as a result, it is the thing of driving force comparatively small as a driving source of a rod-like structure, and a good thing is obtained.
[0048] Moreover, according to the 2nd invention, since the air cylinder was used as said driving source, it is effective in a thing comparatively simple [the device of said driving source] and cheap being obtained.
[0049] Moreover, since the vaccum pressure measurement means in bellows detected the vaccum pressure of said cavernous section in bellows which holds the vaccum pressure of the cavernous section in bellows to a predetermined value in a normal state, and follows and changes to vacuum processing indoor vaccum pressure at the time of abnormalities, such as breakage in said bellows, according to the 3rd invention, the abnormalities in said bellows are detectable at an early stage.
[0050] Moreover, according to the 4th invention, since the comparison of the measurement value by the vacuum processing indoor vaccum pressure measurement means and the vaccum pressure measurement means in bellows detected the vaccum pressure of said cavernous section in bellows, it is effective in what can detect abnormalities still more certainly being obtained.
[0051] Furthermore, according to the 5th invention, with the vacuum pump which carries out evacuation

of the vacuum processing interior of a room, since it had the vacuum pump of another system and the cavernous section in bellows was exhausted, fluctuation of the vaccum pressure in the cavernous section in bellows at the time of abnormalities can be detected more certainly, and it is effective in that to which certainty is made at an early stage and abnormalities, such as comparatively minute leakage in said bellows, are made as for detection to high degree of accuracy being obtained.
[0052] Furthermore, since the vacuum pump which carries out evacuation of the vacuum processing interior of a room as an exhaust air means in bellows was shared according to the 6th invention since it is held to about 1 law always [of said bellows / forward], and the vaccum pressure of said cavernous section in bellows follows vacuum processing indoor vaccum pressure at the time of the abnormalities of said bellows and is changed While this abnormality is certainly detectable, it can fly in a vacuum processing room and vaccum pressure management with the cavernous section in Lowe's can be simplified, operation management is easy and some which can attain space-saving-izing of a facility and low cost-ization have the ****** effectiveness.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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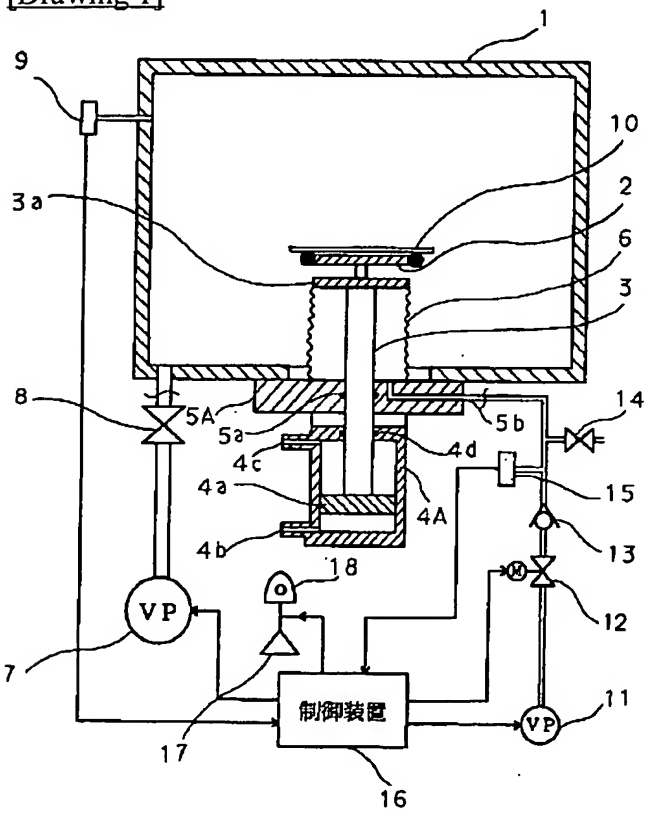
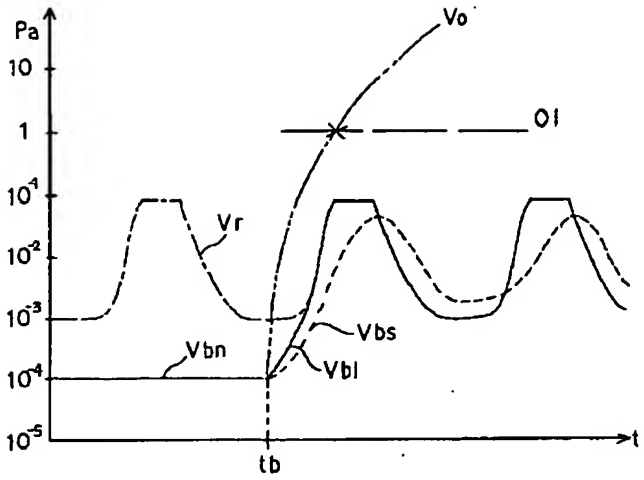
DRAWINGS

[Drawing 1]

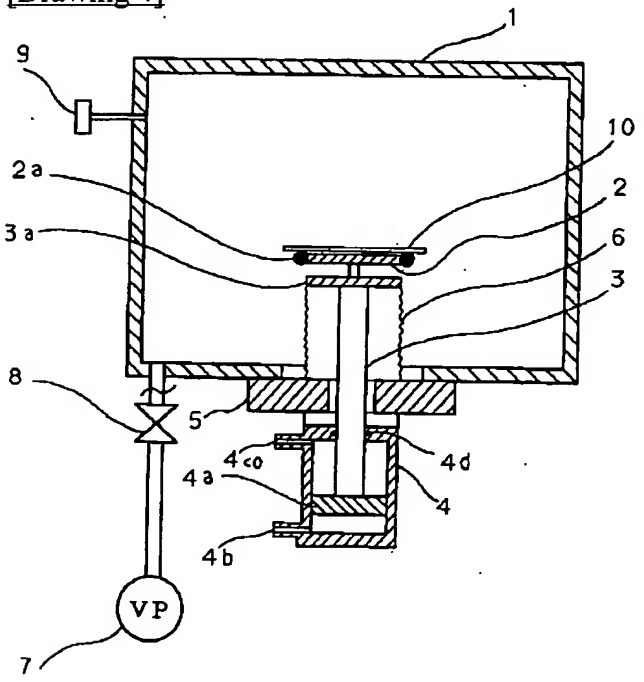


[Drawing 2]



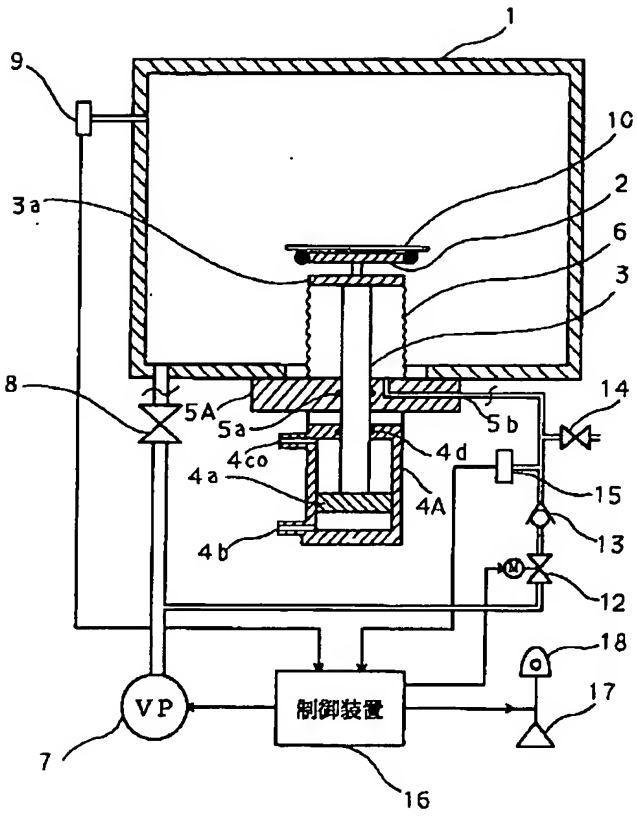
Vr：真空室内真空圧力
Vbn：正常時のベローズ内真空圧力
Vbl：ベローズ破損大時のベローズ内真空圧力
Vbs：ベローズ破損小時のベローズ内真空圧力
Vo：Oリング漏れ時のベローズ内真空圧力
Ol：Oリング漏れ検出レベル
tb：ベローズ破損時刻

[Drawing 4]



[Drawing 3]

h g cg b eb cg e e



[Translation done.]

h g cg b eb cg e e .

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a schematic diagram including the important section cross section in the vacuum processor as a gestalt 1 of implementation of this invention.
[Drawing 2] It is the explanatory view of the vacuum processor shown in drawing 1 of operation.
[Drawing 3] It is a schematic diagram including the important section cross section in the vacuum processor as a gestalt 2 of implementation of this invention.
[Drawing 4] It is a schematic diagram including the important section cross section in the conventional vacuum processor.
[Description of Notations]
1 Vacuum Processing Room, 2 Wafer Support, 3 Shaft, 4A Air Cylinder, 4a piston, 4b, c An air gate, 5A A flange, 5a Vacuum O ring, 6 bellows, 6a A bellows end plate, 7 A vacuum pump, 8 Exhaust air bulb, 9 A vaccum pressure sensor, 10 A semi-conductor wafer, 11 A vacuum pump, 12 An exhaust air bulb, 13 check valves, 14 The bulb for a purge, 15 A vaccum pressure sensor, 16 A control device, 17 buzzers, 18 PATORAITO

[Translation done.]